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PRACTICE PAPER (2023-24)
CHAPTER 01 SETS (ANSWERS)

SUBJECT: MATHEMATICS
CLASS : XI

MAX. MARKS : 40
DURATION : 1½ hrs

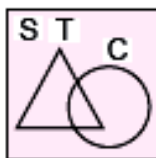
General Instructions:

- (i). All questions are compulsory.
- (ii). This question paper contains 20 questions divided into five Sections A, B, C, D and E.
- (iii). **Section A** comprises of 10 MCQs of 1 mark each. **Section B** comprises of 4 questions of 2 marks each. **Section C** comprises of 3 questions of 3 marks each. **Section D** comprises of 1 question of 5 marks each and **Section E** comprises of 2 Case Study Based Questions of 4 marks each.
- (iv). There is no overall choice.
- (v). Use of Calculators is not permitted

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. The number of subsets of a set containing n elements is
(a) 2^n (b) $2^n - 1$ (c) 2^{n-1} (d) n^n
Ans: (a), if a set contains n elements then there are 2^n subsets of the set.
2. Let $A = \{2, 5\}$, then subsets of set A are ϕ , $\{2\}$, $\{5\}$, $\{2, 5\}$, i.e. 4 subsets then the number of elements its power set contains are
(a) 4 (b) 42 (c) 10 (d) 2
Ans: (a) 4
 $A = \{2, 5\}$, $P(A) = \{\phi, \{2\}, \{5\}, \{2, 5\}\}$, then $n[P(A)] = 2^2 = 4$
3. The set $(A \cap B)' \cup (B \cap C)$ is equal to
(a) $A' \cup B \cup C$ (b) $A' \cup B$ (c) $A' \cup C'$ (d) $A' \cap B$
Ans: (b) $A' \cup B$
 $(A \cap B)' \cup (B \cap C) = \{A' \cup (B)'\} \cup (B \cap C) = (A' \cup B) \cup (B \cap C) = A' \cup B$
4. Let S = set of all points inside the square, T = the set of points inside the triangle and C = the set of points inside the circle. If the triangle and circle intersect each other and are contained in a square. Then
(a) $S \cap T \cap C = \phi$ (b) $S \cup T \cup C = C$ (c) $S \cup T \cup C = S$ (d) $S \cup T = S \cap C$
Ans: (c) $S \cup T \cup C = S$



5. If set A: numbers multiple of 4 and set B: numbers multiple of 6, then set $A \cap B$ is
(a) numbers multiple of 2 (b) numbers multiple of 4
(c) numbers multiple of 12 (d) numbers multiple of 24
Ans: (c) numbers multiple of 12
As LCM of 6 and 4 is 12
6. For disjoint sets A and B, $n(A) = 3$, $n(B) = 5$, then $n(A \cap B)$ is
(a) 0 (b) 3 (c) 5 (d) 8
Ans: (a) 0, as $A \cap B = \phi$

7. Representation of set $A = \{x \mid x \in \mathbb{Z}, x^2 < 20\}$ in the roster form is
 (a) $\{1, 2, 3, \dots, 20\}$ (b) $\{1, 2, 3, 4\}$
 (c) $\{0, 1, 2, 3, 4\}$ (d) $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$
 Ans: (d) $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$
 We observe that the squares of integers $0, \pm 1, \pm 2, \pm 3, \pm 4$ are less than 20.
 Therefore, the set A in roster form is
 $A = \{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$.

8. The set $\{-1, 1\}$ in the set builder form can be written as
 (a) $\{-1, 1\}$ (b) $\{x \in \mathbb{W} : x \leq 1\}$
 (c) $\{x \in \mathbb{Z} : x \leq 1\}$ (d) $\{x : x \text{ is a solution of } x^2 = 1\}$
 Ans: (d) $\{x : x \text{ is a solution of } x^2 = 1\}$
 Elements are -1 and 1 , we can have $x^2 = 1, x \in \mathbb{Z}$ or \mathbb{Q} or \mathbb{R}
 \therefore set is $\{x : x \text{ is a solution of } x^2 = 1\}$.

For Q9 and Q10, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct answer out of the following choices.

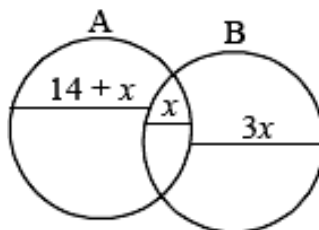
- (a) Both A and R are true and R is the correct explanation of A.
 (b) Both A and R are true but R is not the correct explanation of A.
 (c) A is true but R is false.
 (d) A is false but R is true.
9. **Assertion (A):** The set $A = \{x : x \text{ is an even prime number greater than } 2\}$ is the empty set.
Reason (R): The set $B = \{x : x^2 = 4, x \text{ is odd}\}$ is not an empty set.
 Ans: (c) Assertion is true and Reason is false
 Assertion: 2 is the only even prime number. So, set A is the empty set.
 Reason: The equation $x^2 = 4$ is not satisfied by any odd value of x. So, set B is the empty set.
 Hence, Assertion is true and Reason is false.

10. **Assertion (A):** If $n(A) = 3, n(B) = 6$ and $A \subset B$, then the number of elements in $A \cup B$ is 9.
Reason (R): If A and B are disjoint, then $n(A \cup B)$ is $n(A) + n(B)$.
 Ans: (d) Assertion is false and Reason is true
 Assertion: $A \subset B$
 $\Rightarrow n(A \cup B) = n(B) = 6$
 Reason: If A and B are disjoint, then $n(A \cup B) = n(A) + n(B)$
 Hence, Assertion is false and Reason is true.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. A and B are two sets such that : $n(A - B) = 14 + x, n(B - A) = 3x$ and $n(A \cap B) = x$, draw a Venn diagram to illustrate information and if $n(A) = n(B)$ then find the value of x.
 Ans: Given $n(A - B) = 14 + x$;
 $n(B - A) = 3x$,
 $n(A \cap B) = x$



$$n(A) = n(B)$$

$$\Rightarrow n(A - B) + n(A \cap B) = n(B - A) + n(A \cap B)$$

$$\Rightarrow 14 + x + x = 3x + x \Rightarrow 14 = 2x \Rightarrow x = 7$$

12. Two finite sets have m and n elements. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. Find the values of m and n .

Ans: Number of subsets of A = 2^m

Number of subsets of B = 2^n

$$2^m - 2^n = 56$$

$$2^n (2^{m-n} - 1) = 2^3 (2^3 - 1)$$

$$\Rightarrow n = 3 \text{ and } m - n = 3 \Rightarrow n = 3 \text{ and } m = 6.$$

13. A and B are two sets such that $n(A) = 3$ and $n(B) = 6$. Find (i) minimum value of $n(A \cup B)$ (ii) maximum value of $n(A \cup B)$.

Ans: $n(A \cup B)$ is minimum when $n(A \cap B)$ is maximum, i.e. 3.

$$\therefore \text{Minimum } n(A \cup B) = 6.$$

$n(A \cup B)$ is maximum when $n(A \cap B)$ is minimum, i.e. 0.

$$\therefore \text{Maximum } n(A \cup B) = 9.$$

14. If $U = \{x : x \leq 10, x \in \mathbb{N}\}$, $A = \{x : x \in \mathbb{N}, x \text{ is prime}\}$, $B = \{x : x \in \mathbb{N}, x \text{ is even}\}$, write $A \cap B'$ in roster form.

Ans: $U = \{1, 2, 3, \dots, 10\}$ $A = \{2, 3, 5, 7\}$

$B = \{2, 4, 6, 8, 10\}$ $B' = \{1, 3, 5, 7, 9\}$

$$\Rightarrow A \cap B' = \{2, 3, 5, 7\} \cap \{1, 3, 5, 7, 9\} = \{3, 5, 7\}.$$

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. In an examination, 80% students passed in Mathematics, 72% passed in Science and 13% failed in both the subjects, if 312 students passed in both the subjects. Find the total number of students who appeared in the examination.

Ans: Let total students = 100 Let $n(U) = 100$

Then number of students passing in Mathematics = 80, $n(M) = 80$

Number of students passing in Science = 72, $n(S) = 72$

Number of students passing in at least one of the Subjects = 87, $n(M \cup S) = 87$

$$\therefore n(M \cup S) = n(M) + n(S) - n(M \cap S)$$

$$\Rightarrow 87 = 80 + 72 - n(M \cap S)$$

$$\Rightarrow n(M \cap S) = 65$$

So 65% passed in both the subjects.

Let total number of students = x

$$\Rightarrow 65\% \text{ of } x = 312$$

$$\Rightarrow x = \frac{100}{65} \times 312 = 480.$$

Total number of students are 480.

16. Let A, B and C be three sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$. Show that $B = C$.

Ans: We have $A \cup B = A \cup C$

$$\Rightarrow (A \cup B) \cap C = (A \cup C) \cap C$$

$$\Rightarrow (A \cap C) \cup (B \cap C) = C$$

$$\Rightarrow (A \cap B) \cup (B \cap C) = C \quad \dots(i) \quad [As A \cap C = A \cap B]$$

Again $A \cup B = A \cup C$

$$\Rightarrow (A \cup B) \cap B = (A \cup C) \cap B$$

$$\Rightarrow B = (A \cap B) \cup (B \cap C) \quad \dots(ii)$$

From (i) and (ii), we get $B = C$

17. Let $U = \{1, 2, 3, 4, 5, 6, 8\}$, $A = \{2, 3, 4\}$, $B = \{3, 4, 5\}$. Show that $(A \cup B)' = A' \cap B'$ and $(A \cap B)' = A' \cup B'$

Ans: Given $U = \{1, 2, 3, 4, 5, 6, 8\}$, $A = \{2, 3, 4\}$, $B = \{3, 4, 5\}$

$A \cup B = \{2, 3, 4\} \cup \{3, 4, 5\} = \{2, 3, 4, 5\}$

$\therefore (A \cup B)' = \{2, 3, 4, 5\}' = \{1, 6, 8\}$... (i)

$A' = \{2, 3, 4\}' = \{1, 5, 6, 8\}$

$B' = \{3, 4, 5\}' = \{1, 2, 6, 8\}$

$\therefore A' \cap B' = \{1, 5, 6, 8\} \cap \{1, 2, 6, 8\} = \{1, 6, 8\}$... (ii)

From (i) and (ii), we get

$(A \cup B)' = A' \cap B'$.

Now, $A \cap B = \{2, 3, 4\} \cap \{3, 4, 5\} = \{3, 4\}$

$(A \cap B)' = \{1, 2, 5, 6, 8\}$... (iii)

$A' \cup B' = \{1, 5, 6, 8\} \cup \{1, 2, 6, 8\} = \{1, 2, 5, 6, 8\}$... (iv)

From (iii) and (iv), we get

$(A \cap B)' = A' \cup B'$.

SECTION – D

Questions 18 carry 5 marks.

18. In a group of 50 students, the number of students studying French, English, Sanskrit were found to be as follows :

French = 17, English = 13, Sanskrit = 15

French and English = 9, English and Sanskrit = 4

French and Sanskrit = 5, English, French and Sanskrit = 3. Find the number of students who study

(i) French only

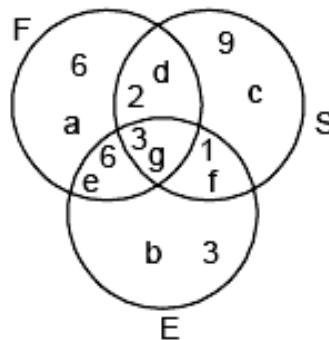
(ii) English only

(iii) Sanskrit only

(iv) English and Sanskrit but not French

(v) French and Sanskrit but not English

Ans: F : set of students studying French



E : set of students studying English

S : set of students studying Sanskrit

$n(F) = 17$, $n(E) = 13$, $n(S) = 15$, $n(F \cap E) = 9$, $n(E \cap S) = 4$, $n(F \cap S) = 5$, $n(E \cap F \cap S) = 3$

Given $a + d + g + e = 17$... (i)

$b + f + c + g = 13$... (ii)

$c + d + g + f = 15$... (iii)

$c + g = 9$... (iv)

$g + f = 4$... (v)

$d + g = 5$... (vi)

$g = 5$... (vii)

From (i) to (vii) we get

$d = 2, f = 1, e = 6, a = 6, b = 3, c = 9$

(i) Number of students studying French only = $a = 6$.

(ii) Number of students studying English only = $b = 3$

(iii) Number of students studying Sanskrit only = $c = 9$

(iv) Number of students studying English and Sanskrit but not French = $f = 1$.

(v) Number of students studying French and Sanskrit but not English = $d = 2$

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. In a city of 56,000 people, following is the number of fans of players Rohit (R), Virat (V) and Dhoni (D):



Players	Number of Fans
Rohit	23,000
Virat	25,000
Dhoni	18,000
Rohit and Virat	12,000
Rohit and Dhoni	10,000
Virat and Dhoni	8,000
Rohit, Virat and Dhoni	3,000

Based on the above information, answer the following:

(i) How many people are fans of at least 2 players?

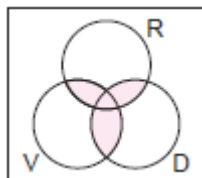
(ii) How many people are fans of exactly 1 player?

(iii) How many people are fans of exactly 2 players?

(iv) How many people follow R or V but not D?

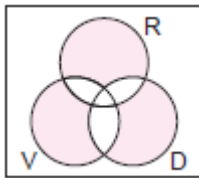
Ans:

(i)



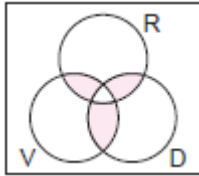
$$\begin{aligned} & n[(R \cap V) \cup (V \cap D) \cup (R \cap D)] \\ &= n(R \cap V) + n(V \cap D) + n(R \cap D) - [n(R \cap V) \cap (V \cap D) + n(V \cap D) \cap (D \cap R) + n(V \cap R) \cap (R \cap D)] \\ &+ n[(R \cap V) \cap (V \cap D) \cap (R \cap D)] \\ &= n(R \cap V) + n(V \cap D) + n(R \cap D) - 3 \cdot n(R \cap V \cap D) + n(R \cap V \cap D) \\ &= n(R \cap V) + n(V \cap D) + n(R \cap D) - 2n(R \cap V \cap D) \\ &= 12,000 + 8,000 + 10,000 - 2 \times 3,000 = 24,000 \end{aligned}$$

(ii)



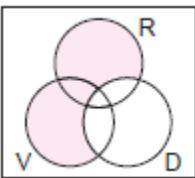
$$\begin{aligned} n(R \cup V \cup D) - n(\text{At least 2 players}) \\ = 39,000 - 24,000 = 15,000 \end{aligned}$$

(iii)



$$\begin{aligned} n(\text{At least 2 players}) - n(R \cap V \cap D) \\ = 24,000 - 3,000 = 21,000 \end{aligned}$$

(iv)



$$\begin{aligned} n(R \cup V) - n(V \cap D \cup R \cap D) \\ = n(R) + n(V) - n(R \cap V) - [n(V \cap D) + n(R \cap D) - n(V \cap D \cap R \cap D)] \\ = n(R) + n(V) - [n(R \cap V) + n(V \cap D) + n(R \cap D)] + n(R \cap V \cap D) \\ = 23,000 + 25,000 - (12,000 + 8,000 + 10,000) + 3,000 = 21,000 \end{aligned}$$

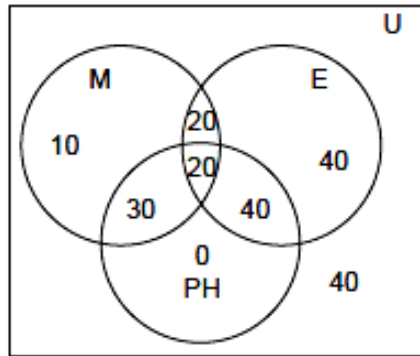
20. In class XI of one International school in Hyderabad, there are 200 students out of which 80 have taken Mathematics, 120 have taken Economics and 90 have taken Physical Education. If 50 have taken Mathematics and Economics, 60 have taken Economics and Physical Education, 40 have taken Mathematics and Economics.



If 20 students have taken all three subjects then on the basis of above information answer the following:

- Find the number of students who have taken at least one of the subjects.
- Find the number of students who have taken at most one of the subjects.
- Find the number of students who has taken none of the subject.
- Find the number of students who have taken exactly one subject.

Ans: Let 'M' represent the set of students who have taken Maths. 'E' represent the set of students who have taken Economics. 'PH' represent the set of students who have taken Physical Education.



- (i) at least one of the subjects = $M \cup E \cup PH = 10 + 40 + 20 + 40 + 30 + 20 = 160$
(at least one subject means one subject or two subjects or three subjects)
- (ii) at most one of the subjects = one subject or none of the subjects = $10 + 40 + 40 + 0 = 90$
- (iii) None of the subjects = 40
- (iv) exactly one subject = $10 + 40 + 0 = 50$

